RESPONSE ACTION CONTRACT

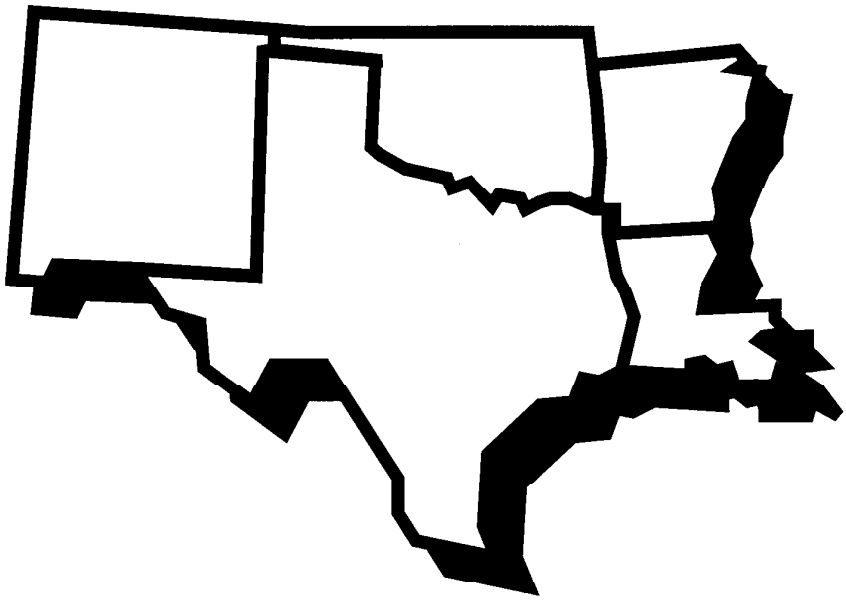
United States Environmental Protection Agency Region 6

Contract No. 68-W6-0036

Version 1.1

Qaulity Assurance Project Plan
Remedial Investigation/Feasibility Study
Griggs and Walnut Groundwater Plume Site
Las Cruces, New Mexico

Response Action Contract No. 68-W6-0036
Work Assignment No. 961-RICO-06HZ
DCN 01-3464



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Geo-Marine, Inc.

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Version 1.1

Quality Assurance Project Plan
Griggs and Walnut Groundwater Plume Site
Las Cruces, Doña Ana County, New Mexico

Response Action Contract No. 68-W6-0036
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Prepared for:

U.S. Environmental Protection Agency

Prepared by:
CH2M HILL, INC
March 2002

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Preface

The U. S. Environmental Protection Agency, Region 6 (EPA) has retained CH2M Hill, Inc. under Response Action Contract No. 68-W6-0036, Work Assignment No. 961-RICO-06HZ to develop the site-specific planning documents for the Remedial Investigation/Feasibility Study (RI/FS) at the Griggs and Walnut Groundwater Plume (GWP) Site in Las Cruces, Doña Ana County, New Mexico. The site-specific planning documents for the GWP RI/FS consist of the following five separately-bound documents:

- RI/FS Technical Activities Work Plan (**CH2M HILL, 2002a**)
- Field Sampling Plan (**CH2M HILL, 2002b**)
- Quality Assurance Project Plan
- Site Management Plan (**CH2M HILL, 2002c**)
- Health and Safety Plan (**CH2M HILL, 2002d**)

The RI/FS Technical Activities Work Plan (TAWP) develops a Site Conceptual Model and outlines Data Quality Objectives based on a detailed review of the historical information available for the site and provides a general description of the tasks to be conducted during the RI/FS. The Field Sampling Plan (FSP) provides detailed methods and procedures to be used during implementation of field activities in order to obtain the information required to complete the RI/FS. The Site Management Plan (SMP) provides detailed procedures for site control and security and management of investigation-derived waste to be utilitzed during implementation of the field work. Health and Safety procedures to be used during implementation of the RI/FS field activities are presented in the Health and Safety Plan (HSP).

This Quality Assurance Project Plan (QAPP) provides Quality Control/Quality Assurance requirements to ensure that the data which obtained is suitable for its intended purpose. It has been prepared as a companion document to the other planning documents listed above.

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TABLES

FIGURES

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Acronyms

°C	degrees Celsius
ASTM	American Society for Testing and Materials
CLC	City of Las Cruces
CLP	Contract Laboratory Program
COC	chain-of-custody
CompQAP	comprehensive quality assurance plan
CSL	close-support laboratory
CSM	Client Services Manager
DACTD	Doña Ana County Transportation Department
DMP	Data Management Plan
DO	dissolved oxygen
DPT	Direct-Push Technology
DQO	data quality objectives
ELCD	Electrolytic Conductivity Detector
EPA	U.S. Environmental Protection Agency
ERB	equipment rinsate blank
FB	field blank
FD	duplicate field samples
FID	flame ionization detector
FSI	Focused Site Inspection
FSP	Field Sampling Plan
FTL	field team leader
GC/MS	gas chromatograph/mass spectrometer
GWP	Griggs and Walnut Groundwater Plume Site
HRS	Hazard Ranking System
HSM	Health and Safety Manager
HSP	Health and Safety Plan
IDW	investigation-derived waste
LUST	Leaking Underground Storage Tank
MCL	Maximum Concentration Level

MDL	maximum detection limit
mg/L	milligrams per liter
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
NIST	National Institute of Standards and Technology
NMED	New Mexico Environment Department
ORP	oxidation-reduction potential
OVA	Organic Vapor Analyzer
P	percent recovery
PARCC	precision, accuracy, representativeness, comparability, and completeness
PC	project chemist
PCE	Tetrachloroethene or Perchloroethene
PCR	property control representative
PDM	project database manager
pH	hydrogen (ion) concentration
PID	photo ionization detector
PM	project manager
ppb	parts per billion
PPE	personal protective equipment
PQL	practical quantitation limit
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
RAC	Response Action Contract
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
RSCC	regional sample control coordinator (EPA)
RTL	review team leader

SAP	Sampling and Analysis Plan
SOW	Statement of Work
SOV	Soil Organic Vapor
SSC	site safety coordinator
TAWP	Technical Activities Work Plan
TB	temperature blank
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
µg/L	micrograms per liter
VOC	volatile organic compound
WAM	work assignment manager

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Section 1
Project Management

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Section 1

Project Management

The purpose of this document is to present the quality assurance and quality control (QA/QC) requirements for performing a Remedial Investigation/Feasibility Study (RI/FS) at the Griggs and Walnut Groundwater Plume (GWP) Site, located near the intersection of Griggs Avenue and Walnut Street in Las Cruces, Doña Ana County, New Mexico. This section provides a brief site background and the roles and responsibilities for the QA/QC team.

1.1 Introduction

The site currently consists of five municipal water supply wells known to be contaminated with tetrachloroethylene (also known as perchloroethylene or PCE). A Focused Site Inspection (FSI) was conducted at this site by the New Mexico Environment Department from 1997 to 2000. The FSI confirmed the presence of PCE in the municipal water supply at City of Las Cruces (CLC) municipal wells Nos. 18, 19, 21, and 27 (**EPA, 2000b**). Additional sampling conducted by the city in the summer of 2001 has since confirmed the presence of PCE in CLC Well No. 24. The RI/FS process is the means by which the nature and extent of risks posed by a hazardous waste site are quantified, and potential remedial options are evaluated, sufficient to support an informed risk management decision regarding remedial action for the site. This Quality Assurance Project Plan (QAPP) is prepared as a component of the Sampling and Analysis Plan (SAP) for the Griggs and Walnut Groundwater Plume Site and has been prepared in accordance with the U.S. Environmental Protection Agency's (EPA) 1998 Guidance (**EPA, 1998**). The Field Sampling Plan (FSP) **(CH2M HILL, 2002b**), provided under separate cover, details the field activities to be conducted in support of the RI/FS. The FSP and the QAPP together comprise the SAP for this RI.

QA involves all those planned and systematic actions necessary to provide adequate confidence that field activities will be performed satisfactorily and safely. The goal of QA is to ensure that activities are planned and performed according to accepted standards and practices to ensure that the resulting data are valid and useable for the project decision-making process, while continuing to meet safety requirements. QC is an integral part of the overall QA function and is comprised of all those actions

necessary to control and verify that project activities and the resulting data meet established requirements.

The requirements of this document apply to CH2M HILL and its subcontractors. Deviations from these procedures will be documented and included in the final report.

Provided in **Section 1** of this QAPP is a description of the project management responsibilities and data objectives. **Section 2** describes the measurement and data acquisition procedures, and analytical methods to be used for this event. **Section 3** provides a description of assessment and oversight responsibilities. **Section 4** discusses the data review, validation, and verification requirements, and **Section 5** contains references.

1.2 Project QA/QC Roles and Responsibilities

This section identifies key project team members associated with the planned sampling event and lists the QA/QC responsibilities associated with each position. The organizational structure and responsibilities are designed to provide project control and quality assurance for the proposed investigation. The project team and their roles are shown on **Figure 1-1**.

U.S. Environmental Protection Agency Work Assignment Manager - Ms. Petra Sanchez. The Work Assignment Manager (WAM) will serve as the primary point of contact for the EPA, and will provide guidance and direction to the contractor throughout the project.

Program Manager - Mr. Al Sloan. The Program Manager is a senior level management person who coordinates all of the project efforts for the Response Action Contract (RAC) Program.

Project Manager - Margaret O'Hare. The Project Manager (PM) is responsible for overall activities for a specific project. The PM is responsible for cost and schedule control and for technical quality; in addition, she develops the work plan and monitors task order activities to ensure

compliance with project objectives and scope. The PM also communicates with the City of Las Cruces, Doña Ana County, and, as appropriate, other designated parties regarding project progress.

The PM has ultimate responsibility within the project team for producing deliverables that are technically adequate, satisfactory to the client, and cost-effective. To accomplish this, the PM develops an internal project review schedule, provides written instructions and frequent guidance to the project team, and monitors budgets and schedules. The PM works with the project team to select an internal QA/QC review team and to coordinate review efforts, and works with the project team in addressing review comments and adjudicating technical disagreements.

Review Team Leader - Mr. Peter van Noort. Mr. van Noort is the Review Team Leader (RTL) for this project. As the RTL, he is responsible for reviewing major project deliverables prior to submittal to the EPA. Mr. van Noort and other team members will also serve as technical resources to the project team throughout the duration of the work assignment on an as needed basis for each task.

Lead Risk Assessor - John Coffey. The lead risk assessor provides guidance and input into the project planning stages, and directs the human health risk assessment for the project.

Project Chemist - John Coffey. The Project Chemist (PC) assists with the preparation of the project work planning documents, provides a point of communication between the laboratory and the project team, supervises the analytical data quality evaluation, and participates in preparing deliverables to the client. The PC coordinates with the project team and the analytical laboratory during the field activities. The PC is also responsible for monitoring project-specific laboratory activities (including checking laboratory invoices and reports) and may audit the laboratory or field operations at the PM's direction. The PC also monitors field and laboratory activities such that QA/QC requirements described in this project-specific QAPP are coordinated effectively.

Field Team Leader - Mr. Tim McDonald. The Field Team Leader (FTL) reports to the PM and is responsible for the coordination of field efforts, provides for the availability and maintenance of

sampling equipment and materials, and provides shipping and packing materials. The FTL will supervise completion of all chain-of-custody (COC) records, supervise the proper handling and shipping of samples, and be responsible for accurate completion of the field notebooks. As the lead field representative, the FTL will be responsible for consistently implementing program QA/QC measures at the site and for performing field activities in accordance with approved work plans, policies, and field procedures.

Project Database Manager - To Be Determined. The Project Database Manager (PDM) is responsible for the structure, organization, format, implementation, and operation of the project database. The PDM also works with the database on a daily basis and provides normal deliverables (for example, data summary tables) to the project team.

Property Control Representative - Mr. Darren Davis. The Property Control Representative (PCR) is responsible for recording all received and issued government-owned materials and equipment, inspecting materials and equipment for damages, and storing and stocking materials and equipment as outlined in the PCR Desk Operating Instruction (provided in Appendix A of the FSP). These instructions provide guidelines for the accountability of Federal Government owned material acquired as a direct charge to a project.

Site Safety Coordinator - Tim McDonald. The Site Safety Coordinator (SSC) develops and implements the project Health and Safety Plan (HSP) in the field. The SSC will assist in conducting site briefings and perform all final safety checks. The SSC is responsible for stopping any investigation-related operation that threatens the health and safety of the field team or surrounding populace.

Regional Health and Safety Manager - Mr. Michael Goldman. The Health and Safety Manager (HSM) reviews and approves the project-specific HSP as well as subcontractor HSPs. The HSM serves as the point of contact for the SSC for any health and safety-related issues, and may conduct

project audits. The HSM is also responsible for investigating accidents should any occur during the course of the project.

1.2.1 Laboratory Work Group

Four separate laboratories will be responsible for analysis of samples collected during field activities, these four labs will include the Contract Laboratory Program (CLP) laboratory, a non-CLP/EPA laboratory, an onsite soil vapor laboratory, and an offsite soil vapor laboratory. Further discussion of issues related to each laboratory is provided in **Section 2**. For the samples that are not analyzed through the CLP program, the laboratory PM or client services manager (CSM) acts as a liaison between field and laboratory operations and is responsible for the following:

- Receipt of sample custody from the field team members, verification of sample integrity, and transfer of sample fractions to the appropriate analytical departments
- Coordination of sample analyses to meet project objectives
- Preparation of analytical reports
- Review of laboratory data for compliance with method requirements
- Review of any QC deficiencies reported by the analytical department manager
- Coordination of any data changes resulting from review by the project QA supervisor or the PM
- Completion of data package deliverables
- Response to questions from the project team during the data quality evaluation process

The EPA Regional Sample Control Coordinator (RSCC) will be a liaison regarding analytical, data validation, and quality assurance issues for the groundwater samples analyzed through the CLP.

1.2.2 Project Communication

Effective communication among all project personnel shall be established and maintained through the course of the project. At the beginning of the project, and/or at the start or end of major milestones, the PM will prepare written project instructions that will be distributed to all team

members. These instructions will document project and task objectives, and each team member's responsibility in meeting the objectives, as well as a budget and schedule for successfully executing the work.

Before field activity begins, a project team meeting will be held to review the project objectives. Periodic meetings will be held to review data validity, technical evaluations, major decisions, and overall progress toward completing the project. Additionally, a team kickoff meeting will be held before work on each task is started. Senior personnel, including the RTL, will participate in the meetings to help focus the project approach and to define specific issues.

During the field investigation phase of this project, the field team will meet daily to review the status of the project and to discuss technical and safety issues. When necessary, other meetings will be scheduled or the FTL will meet individually with field personnel, EPA personnel, City personnel, or County personnel to resolve problems. Following the field effort, the FTL will prepare a trip report detailing project progress.

During the field effort, the FTL will be in regular telephone or face-to-face contact with the project team. When significant problems or decisions requiring additional authority occur, the FTL can immediately contact the PM for assistance. The PC will coordinate communication with the laboratory through sample collection, sample analysis, and data quality evaluation and consult with the RAC 6 program manager as directed by the PM.

All communications with the EPA, the City of Las Cruces, and Doña Ana County will be channeled through the PM. However, the FTL may contact the City and County as directed by the PM.

1.3 Problem Definition and Background

CLC wells Nos. 18, 19, 21, 24, and 27 are five of 30 municipal wells within the City used to provide drinking water. CLC Well No. 18 is currently inactive and is located in the east area of the City. The City of Las Cruces is located in the southern part of the New Mexico in Doña Ana County. The

Mesilla Bolson Aquifer is the sole source of drinking water within Doña Ana County. Direct contact to groundwater is the major exposure pathway of concern (**EPA, 2000b**).

PCE contamination at the site was first identified in CLC Wells Nos. 21 and 27 in 1993. In 1995, PCE was detected above the maximum concentration limit (MCL) for PCE of 5 micrograms per liter (ug/L) in CLC Well No. 18. Use of CLC Well No. 18 was suspended in 1996 due to the discovery of PCE and due to operational issues. The concentration of PCE has been detected at levels up to 47 ug/L in CLC Well No. 18 (**EPA, 2000b**). In addition, PCE has been detected in CLC Wells Nos. 19, 21, 24, and 27 at concentrations below the MCL. However, use of CLC Well No. 27 for drinking water has been suspended due PCE concentrations that are near the MCL (maximum PCE concentration detected by the City was 4.9 ug/L in the summer of 2001). Historically, PCE has been primary used as a dry cleaning solvent and for metal parts degreasing. Neither the source of PCE or extent of PCE contamination in groundwater is known.

Several investigations have been conducted at the site prior to initiating the planning process for the RI/FS. Information from these investigations was reviewed to develop the Site Conceptual Model, Data Quality Objectives, and the RI/FS scope of work presented in the Technical Activities Work Plan (TAWP) (**CH2M HILL, 2002a**). These investigations include:

- LUST investigation at the Gas Card Site.
- LUST investigation at the Doña Ana County Transportation Department (DACTD) maintenance yard.
- Focused Site Inspection conducted by the New Mexico Environment Department (NMED)

Each of these investigations is summarized in **Section 2.1.1** of the TAWP (**CH2M HILL, 2002a**). Additional details concerning each of these investigations can be found in the Hazard Ranking System (HRS) documentation Record (**EPA, 2000b**).

The source of the PCE contamination is unknown, and the area of contamination has not been defined. The plume is currently known to be at least 8,000 feet long and 2,000 feet wide. A specific source of the contamination has not yet been identified, but several potential sources of the contamination have been identified based on their proximity to the groundwater plume and the potential use of PCE at those locations (PCE is the only known contaminant associated with the site). The potential sources include dry cleaning facilities, leaking underground storage tank (LUST) sites, the Las Cruces Landfill, and vehicle and equipment maintenance yards. There currently is not enough information to identify these facilities as the source of the contamination (**EPA, 2000b**).

Additional information about the site's history, and a complete summary of investigation activities to date is presented in **Section 1** of the FSP.

1.4 Project Description and Data Quality Objectives

The overall objectives of this sampling effort include the following:

- evaluate the extent of contamination in the subsurface
- investigate the possible sources of contamination
- characterize the risk to human health posed by site contaminants
- collect sufficient data to identify and evaluate potential remedial alternatives

These project objectives have been used to develop specific Data Quality Objectives (DQOs) which are both qualitative and quantitative statements that describe the type and quality of data needed to support future decisions regarding remedial actions at this site. The DQO process used for this project follows the EPA QA/G-4HW guidance **(EPA, 2000c)** and uses the seven-step DQO development process. A discussion of the development of the project-specific DQOs is presented in **Section 4** of the TAWP. These DQOs provide a basis for the RI/FS activities to be performed, and ensure that data collected during the RI/FS will be of sufficient and adequate quality for their intended use. The DQOs and associated RI/FS activities established for the GWP RI/FS at this time are presented in **Table 1-1**.

In order to address the project objectives and DQOs presented in **Table 1-1**, the two main aspects of the work to be performed will be a vadose zone investigation and a hydrogeologic investigation. The vadose zone investigation will include surface and subsurface soil sampling, soil gas sampling via direct-push technology (DPT) and, if necessary, soil vapor monitor well nest installations. The soil gas sampling via DPT will be performed on-site by a subcontractor. Soil gas sampling via soil vapor monitor well nests will be performed by a specialty subcontractor. The hydrogeologic investigation will include the collection of groundwater samples during drilling, water table monitor well installations, multi-level monitor well installations, groundwater sampling and aquifer testing. Details regarding installation and sampling procedures for these activities are provided in **Section 4** of the FSP. Other related support activities include surveying, placement of sample locations and mobilization/demobilization activities. The overall project schedule is outlined in **Section 3** of the Workplan (**CH2M HILL, 2001**). The field sampling will occur during discrete sampling events beginning in fall 2001 and continuing through spring 2002.

1.5 Criteria for Measurement Data

This subsection defines the levels of data that will be generated as part of the RI/FS work activities. The level of data quality is dependent on the objective use of the results supported by the data. This subsection also provides the quantitative quality objectives and measurement performance criteria for the analytical data.

1.5.1 Levels of Data Quality

Four categories of data will be collected as part of this field effort, and each category has a different level of supporting QA/QC documentation. Level 1 includes field monitoring activities, such as hydrogen (ion) concentration (pH), conductivity, temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO). Level 2 includes the analyses associated with the characterization of the investigation-derived waste (IDW) samples. Samples that are not analyzed through the CLP program will be submitted to the laboratories for level 3 analyses. Samples that are analyzed through the CLP program and/or EPA laboratory will be submitted to the laboratory for level 4 analyses. **Table 1-2**

summarizes the analytical levels that are considered appropriate for each type of data use identified for this RI/FS, the types of analyses, the limitations, and the data quality expected from that analytical level. For each QC level, the measures and methods to be used, as well as the applicable data package deliverables, are outlined below.

1.5.1.1 Level 1–Field Surveys

Level 1 encompasses field monitoring or screening activities and does not require formal data package deliverables. Level 1 activities are focused on easily measured bulk characteristics of a sample such as pH, conductivity, ORP, and DO. Monitoring results, as well as pertinent data concerning the sampling event, will be documented in the bound field book. Level 1 documentation will consist of the following:

- Instrument identification
- Calibration information (standards used and results)
- Date and time of calibration and field measurements
- Field measurement results

The logbooks will be reviewed daily by the FTL for completeness and correctness. No additional documentation or data quality evaluation is required.

1.5.1.2 Level 3 and 4–Laboratory Analysis

The list of methods (presented in **Section 2.4**) and the corresponding target compound lists have been designed to evaluate the potential for contamination at the site. Level 3 and 4 documentation is also presented in **Section 2.4**. Level 4 documentation is the same as level 3, but also includes the raw instrument printouts such as quantitation reports and chromatograms. Samples will be analyzed using methods from the following EPA manuals:

- *Contract Laboratory Program Statement of Work for Organic Analysis, Low Concentration Water*, OLC03.2, December 2000 (**EPA, 2000a**)

- *SW-846, Test Methods for Evaluating Solid Waste*, (**EPA, January 1997**).
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition*. (**EPA, January 1999**). Compendium Methods TO-14A, 15, 16, 17. EPA 625/R-96-010b.

1.5.2 Quality of Data

Analytical performance requirements are expressed in terms of precision, accuracy, representativeness, comparability, and completeness (PARCCs). Summarized below are brief definitions for each PARCCS parameter, and calculation equations as appropriate.

1.5.2.1 Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision is estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the relative percent difference (RPD), and calculated as:

$$RPD = \{(|X_1 - X_2|)/(X_1 + X_2)/2\} \times 100 = \left\{ \frac{|X_1 - X_2|}{\frac{(X_1 + X_2)}{2}} \right\} \times 100$$

X_1 = native sample

X_2 = duplicate sample

1.5.2.2 Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. It is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix is the preferred technique because it provides a measure of the matrix effects on analytical accuracy. Accuracy, defined as percent recovery (P), is calculated as

$$P = \left[\frac{(SSR - SR)}{SA}\right] x\ 100$$

SSR=spiked sample result, SR=sample result (native), and SA=the spike concentration added to the spiked sample.

1.5.2.3 Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness is demonstrated by providing full descriptions of the sampling techniques and the rationale used for selecting sampling locations in the project planning documents.

There cannot be a target goal for a qualitative parameter such as representativeness or comparability. Therefore, this criterion is completed and evaluated subjectively rather than quantitatively. The measure for representativeness is answered during the preparation of the sampling and analysis approach and rationale and then reassessed during the data usability process. For example, an integral part of developing the sampling and analysis approach and rationale is to answer the question "How many samples are needed to fully evaluate *x*." Then, during the data usability process, the question "Were enough data collected to answer the original question" must be answered Thus, it is not possible to construct a table with numerical goals that can be used to evaluate these subjective measures.

1.5.2.4 Completeness

Completeness is defined as the percentage of measurements judged to be valid compared to the total number of measurements made for a specific sample matrix and analysis. Completeness is calculated using the following formula:

$$\text{Completeness} = \frac{\text{Valid Measurements}}{\text{Total Measurements}} \times 100$$

Experience on similar projects has shown that laboratories typically achieve about 90 percent completeness. All validated data will be used. During the data validation process, an assessment will be made whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, corrective action will be initiated by the PM.

1.5.2.5 Comparability

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. Sample collection and handling techniques, sample matrix type, and analytical method all affect comparability. Comparability is limited by the other PARCCS parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from one phase of an investigation can be compared to others when similar methods are used and the similar data packages are obtained.

1.6 Special Training Requirements and Certifications

The PM works with the RAC 6 program manager to assemble a project team with the necessary experience and technical skills. Part of the work planning process is to identify special training requirements and certifications necessary to execute the project successfully.

No unique training requirements or certifications were identified as part of the work planning process.

1.7 Documentation and Records

This section defines which records are critical to the project and what information needs to be included in reports, as well as the data reporting format and the document control procedures to be used. It is imperative for the defensibility of critical decisions made at the site that proper documents and records be maintained for the field and offsite data gathering activities, so that specific events can be recreated or independently evaluated. The PM will be responsible for organizing, storing, and cataloging all project information. She is also responsible for collecting records and support data from all project team members. Individual project team members may maintain separate notebooks for individual tasks and these notebooks will be transferred to the PM at the end of the project during project close-out.

1.7.1 Surveying

Details of the surveying activities are provided in the FSP. The elevation (vertical) and horizontal control surveys will be extended to sample locations. Levels of accuracy of +0.1 foot for vertical control and +1 foot for horizontal control are expected. Elevation data will be recorded with reference to a described benchmark.

1.7.2 Field Documentation

Primary fieldwork includes sampling for chemical characterization. Applicable documents and records include the following (copies of forms are provided in the FSP):

- Soil boring logs
- Monitor well construction diagrams
- Well development logs
- Water level data sheets
- Photographic documentation for intrusive, as well as non-intrusive, work
- Field logbook to record data collection activities and observations (including date and time, sample locations, depth, health and safety measures, weather conditions, sampling personnel, analyses requested, and sketches)

- Sample collection field sheets or chain-of-custody documentation
- Field instrument calibration and maintenance logs

Additionally, field quality control and corrective action documents may be generated as a result of field audits.

1.7.3 Laboratory Documentation

As stated previously, a portion of analytical work will be performed through the CLP, for which the data requirements are described in detail in the CLP Statement of Work (SOW) for Organic Analysis, Low Concentration Water (**EPA, 2000a**). These SOWs detail such requirements as information to be included in the data report package, hard copy and electronic reporting formats, and the final disposition requirements (including the location and length of retention) for all analytical records and documents. CLP deliverables include summarized as well as comprehensive data for samples and laboratory QC analyses.

For analytical work to be performed that is not addressed by the procedures specified in the CLP SOWs, deliverable format will be specific to the data being collected. Tracking of samples to be analyzed on and/or offsite will be handled as described in the Data Management Plan (DMP) (provided as **Section 6** of the FSP).

Electronic deliverables will be provided by each offsite laboratory as specified by the database manager.

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Table 1-1 Data Quality Objectives			
Media of Interest	**Data Quality Objective**	**RI/FS Activity**	**Analytes**
Surface soil (0 to 6 inches bgs)	In areas where PCE is detected in shallow subsurface soil vapor, confirm presence/absence of surface soil contamination as a potential secondary source, sufficient to support risk-based decision regarding necessary response actions	• Grid sampling of surface soil for PCE and related constituents. • Measure parameters necessary to evaluate potential response actions. • Collect data adequate to support performance of human and ecological risk assessments.	• Volatile Organics • Physical soil parameters[1]

Table 1-1 Data Quality Objectives			
Media of Interest	**Data Quality Objective**	**RI/FS Activity**	**Analytes**
Soil vapor (vadose zone - 0 to approximately 200 feet bgs)	In areas where PCE is detected in shallow subsurface soil vapor, confirm presence/absence of soil vapor contamination as a potential secondary source and exposure pathway, sufficient to support risk-based decision regarding necessary response actions	• Grid sampling of horizontal and vertical extent of subsurface soil vapor for PCE and related constituents (note: sampling of soil vapor will be conducted in potential source areas if determined to be warranted based on the horizontal and vertical plume definition). • Measure parameters necessary to evaluate potential response actions. • Collect data adequate to support performance of human and ecological risk assessments, using existing data as appropriate to reduce RI data collection.	• Volatile Organics

Table 1-1
Data Quality Objectives

Media of Interest	Data Quality Objective	RI/FS Activity	Analytes
Subsurface soil (6 inches to approximately 200 feet bgs)	In areas where PCE is detected in shallow subsurface soil vapor, confirm presence/absence of surface soil contamination as a potential secondary source, sufficient to support risk-based decision regarding necessary response actions	• Sampling of subsurface soil via direct push (grab) and conventional drilling methods, for both organic and inorganic contamination • Sampling of any non-aqueous phase liquid found, to support future decisions regarding remedial options • Characterize subsurface stratigraphy • Measure parameters necessary to evaluate potential remedial action alternatives • Collect adequate data to perform human health and ecological risk assessments	• Volatile Organics • Inorganics • Physical soil parameters[1] • Chemical and physical characteristics of NAPL[3]
	Above areas where PCE is detected in groundwater and where a source is suspected in overlying soils based on either soil or soil vapor results, confirm presence/absence of PCE in subsurface soil as a potential continuing secondary source to groundwater, sufficient to support risk-based decision regarding necessary response actions.		

Table 1-1
Data Quality Objectives

Media of Interest	Data Quality Objective	RI/FS Activity	Analytes
Groundwater (below water table - below approximately 200 feet bgs)	Confirm horizontal and vertical extent of PCE in groundwater sufficient to make risk-based decision regarding necessary response actions.	• Characterize deeper aquifer conditions via existing onsite water supply and monitoring wells and available logs, and new wells. • Measure parameters necessary to evaluate potential remedial action alternatives • Collect adequate data to perform human health and ecological risk assessments • Sample any non-aqueous phase liquid found, to support future decisions regarding remedial options	• Volatile Organics • Water quality parameters[2] • Chemical and physical characteristics of NAPL[3] • Physical characteristics of aquifer
	Characterize local aquifer properties and flow conditions sufficient to support evaluation of fate and transport of the PCE contamination, sufficient to allow risk-based decisions regarding necessary response actions.	• Geophysical logging to assess deeper aquifer stratigraphy • Aquifer testing to evaluate groundwater flow conditions and contaminant fate and transport with the aquifer • Computer modeling to evaluate groundwater flow conditions, contaminant fate and transport, and to evaluate potential remedial action alternatives.	

Notes:
1. Physical soil/sediment parameters include TOC, pH, grain size, permeability, toxicity, percent moisture, and oil & grease.
2. Water quality parameters include TOC, pH, total dissolved solids, alkalinity, dissolved oxygen, total hardness, and major cations/anions.
3. Chemical/physical parameters of NAPL include BTU, pH, liquid content, ash content, viscosity, density, and organic/inorganic components.

Selection of initial sample locations is based on the need to confirm plume extent. Once the plume extent has been verified, investigations into potential sources will be more effective.

Table 1-2
Summary of Analytical Data Quality Levels
Griggs and Walnut Groundwater Plume Site - RI/FS

Data Use	Analytical Level	Type of Analyses	Limitations	Expected Data Quality
Health and Safety Site Characterization	Level I	Use of portable instruments and field test kits for: C Total organic vapor detection C Water quality parameter measurement	Often not compound-specific or quantitative Instruments may respond to naturally-occurring compounds	If instruments are calibrated and data interpreted correctly, can provide real-time indication of contamination or potentially unsafe working conditions
Site Characterization Evaluation of Alternatives	Level III	Use of on-site, close-support laboratory: C Tentative ID of organic parameters using GC; detection limits low ppb C Analyses will be analyte-specific	Instruments limited mostly to volatile organics (soil gas)	Data typically reported in concentration ranges Data quality dependent on QA/QC steps employed

Table 1-2
Summary of Analytical Data Quality Levels
Griggs and Walnut Groundwater Plume Site - RI/FS

Data Use	Analytical Level	Type of Analyses	Limitations	Expected Data Quality
Site Characterization Risk Assessment Evaluation of Alternatives	Level III	Use of off-site, fixed-base laboratory: C Organic/inorganic parameters, Volatile and Herbicide compounds using GC/MS; detection limits to low ppb level C Analyses are analyte-specific C non-CLP analyses - CLP Data package deliverables, documentation, and validation procedures will be followed as closely as possible C CLP analyses - CLP Data package deliverables, documentation, and validation procedures will be followed. (Volatile data supplied under CLP protocol will be Level 4)	Parameter identification confirmed	non-CLP analyses - Reporting limits similar to CLP

Table 1-2
Summary of Analytical Data Quality Levels
Griggs and Walnut Groundwater Plume Site - RI/FS

Data Use	Analytical Level	Type of Analyses	Limitations	Expected Data Quality
Site Characterization Risk Assessment Evaluation of Alternatives	Level IV	Use of off-site, fixed-base laboratory: C CLP analyses - Volatile data supplied under CLP protocol will be Level 4, CLP Data package deliverables, documentation, and validation procedures will be followed.	Parameter identification confirmed	CLP - analyses - Reporting Limits are specified in the SOW

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Figure 1-1
Project Team Organizational Chart
Griggs and Walnut Groundwater Plume Site
RI/FS

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Section 2
Measurement and Data Acquisition

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Section 2

Measurement and Data Acquisition

This section describes the sampling process design, sampling methods, and sample handling and custody.

2.1 Sampling Process Design

The design of the data collection process for the RI is described in the FSP (**CH2M HILL, 2002b**) and the Work Plan (**CH2M HILL, 2001**). Included in these documents are the types and numbers of samples required, the design of the sampling network, the sampling locations, matrices, and frequencies, and the rational for the design.

Data collected during the course of an RI can be classified as either critical (required to achieve project objectives) or non-critical (informational purposes only). All samples planned for collection as part of the GWP Site RI/FS are classified as critical.

2.1.1 Sample Disposal

The laboratories will be responsible for disposing retained samples in accordance with the contract and applicable regulations.

2.1.2 Management of Investigation-Derived Waste

Management of IDW is detailed in **Section 7** of the FSP. CLC Wells Nos. 18, 19, 21, 24, and 27 are drinking water wells, therefore no hazardous waste will be generated as part of the groundwater sampling portion of this event. Permission will be obtained from the City of Las Cruces for water pumped from their wells to be disposed of in the nearby sanitary sewer. Soil cuttings generated during drilling will be containerized and characterized prior to disposal. It is anticipated that the waste personal protective equipment (PPE) and disposable sampling equipment generated during this event will be disposed of as non-hazardous waste.

2.2 Sampling Methods Requirements

Sampling methods are detailed in **Section 4** of the FSP. The FSP includes instructions for the following procedures:

- Mobilization/Demobilization
- Surveying requirements
- Field parameter measurement
- Geophysical logging
- Soil sample collection
- Soil vapor sample collection
- Water level measurement
- Groundwater sample collection (via both conventional and multi-port wells)
- QC sample collection
- Preservation of samples
- Aquifer testing

Specifics regarding analytical method requirements are provided in **Section 2.4**.

2.3 Sample Handling and Custody Requirements

Proper sample handling, shipment, and maintenance of a COC are key components of building the documentation and support for data that can be used to make project decisions. It is essential that all sample handling and sample COC requirements be performed in a complete, accurate, and consistent manner. Sample handling and custody requirements, as described in the DMP, must be followed for all samples collected as part of the investigation.

The FTL is responsible for proper sampling, labeling of samples, preservation, and shipment of samples to the laboratory to meet required holding times.

2.3.1 Field Documentation

Bound field log books will be maintained by the FTL and other team members to provide a daily record of significant events, observations, and measurements during sampling. All information pertinent to sampling will be recorded in the log books. All entries will be signed and dated and must include at least the following information:

- Name and title of author, date and time of entry, and weather/environmental conditions during the field activity
- Location of sampling activity
- Name and title of field crew
- Name and title of site visitors
- Sample media (e.g., groundwater)
- Sample collection method (e.g., holding the sample container under the faucet)
- Number and volume of sample(s) taken
- Date and time of collection
- Sample identification number(s)
- Sample distribution (e.g., which laboratory the sample was sent to for analysis)
- Field observations
- Field measurements (e.g., pH, temperature, and conductivity)
- All sample documents such as:
  - Bottle lot numbers
  - Dates and method of sample shipments
  - COC forms
- Sample handling (preservation)

All original data recorded in field log books, sample labels, and COC forms will be written with waterproof, black, indelible ink. None of these accountable documents are to be destroyed or thrown away, even if one is illegible or contains inaccuracies requiring document replacement. If an error is made on an accountable document assigned to one individual, that individual should make all

corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections will be initialed and dated.

2.3.2 Sample Containers and Preservatives

The FTL is responsible for proper sampling, labeling of samples, preservation, and shipment of samples to the laboratory to meet required holding times. The sample containers, preservative requirements, and maximum holding times for the common methods used to analyze samples are summarized in **Table 2-1**.

2.3.3 Sample Identification

The PM and FTL will assign sample identifiers for non-CLP samples consistent with the procedures outlined in the FSP. The samples analyzed through the CLP will be assigned sample identifications by the RSCC. Sample identifiers will contain information about the sample location and the sample collection time. The following information will be included on each sample container label:

- Site name or identifier
- Sample identification number
- Date and time of sample collection
- Sample matrix or matrix identifier
- Type of analyses to be conducted

Additional sample volume will be collected for samples identified by the FTL for the laboratory QC (i.e., MS, MSD, DUP) and specified for lab QC use. Additional detail about sample identifiers is included in **Section 5** and **Section 6** (the Data Management Plan [DMP]) of the FSP.

2.3.4 Sample Packing and Shipping

Samples will be delivered to the designated laboratory by a common carrier such as Federal Express. During the field effort, the FTL (or designee) will contact the laboratory daily to inform it about shipments. Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. Vermiculite, bubble wrap, or other materials specified in the FSP will be used as packing material to protect the samples from breaking during shipment.

The following procedures will be used when transferring the samples for shipment:

- Each sample container will be placed in a lock-top bag and sealed.
- Samples for organic, inorganic, and special analysis will be placed in different coolers, as they may be sent to different laboratories. All water volatile organic compound (VOC) vials will be shipped in the same cooler.
- Vermiculite (or other suitable packing material) will be poured and packed into the spaces around the coolers to prevent breakage of the sample containers. Ice will be placed in the coolers to help maintain the cooler temperature at approximately 4 degrees Celsius.
- The appropriate Traffic Report/COC forms (laboratory copies only) will be sealed in a plastic bag and taped to the inside of the cooler lid.
- Coolers will be sealed with strapping tape and at least two EPA custody seals (on opposite sides of the cooler).
- Each container will be clearly marked with “THIS END UP” arrows on all four sides and a sticker containing the originator’s address.

2.3.5 Sample Custody

Sample custody and documentation procedures described in this section will be followed throughout all sample collection activities. Components of sample custody procedures include the use of field log books, sample labels, custody seals, and COC forms. Each person involved with sample handling will be trained in COC procedures prior the start of the field program. The COC form will accompany the samples during shipment from the field to the laboratory. A sample is under custody under the following conditions:

- It is in a person's actual possession
- It is in a person's view, after being in their physical possession
- It was in a person's physical possession and they locked it up to prevent tampering
- It is in a designated and identified secure area.

2.3.5.1 Field Custody

The following procedures will be used to document, establish, and maintain custody of field samples:

- Sample labels will be completed for each sample with waterproof ink, making sure that the labels are legible and affixed firmly on the sample container.
- All sample-related information will be recorded in the project log book.
- The field sampler will retain custody of the samples until they are transferred or properly dispatched.
- To simplify the COC record and minimize potential problems, as few people as possible should handle the samples or physical evidence. For this reason, the FTL will designate one individual from the field sampling team as the responsible individual for all sample transfer activities. This individual will be responsible for the care and custody of the samples until they are properly transferred to another person or facility.
- All samples will be accompanied by a COC record. This record documents the transfer of custody of samples from the field investigator to another person, to the laboratory, or other

organizational elements. Each change of possession must be accompanied by a signature indicating relinquishment and receipt of the samples.

- Completed COC forms will be placed in a plastic cover and placed inside of the shipping container used for sample transport from the field to the laboratory.
- When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill or receipt will be recorded on the COC form and in the site logbook.
- Custody seals will be used on each sample container and on the shipping containers when samples are shipped to the laboratory to inhibit sample tampering during transportation.
- A copy of completed COC forms will be faxed to the PC and PDM.

2.3.5.2 Laboratory Sample Custody

Each laboratory receiving samples for this project must comply with the laboratory sample custody requirements outlined in its Quality Assurance Plan (QAP). The FTL or the PC will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, as well as the expected date of arrival.

For samples analyzed through the CLP program, the laboratory will follow the procedures established by the CLP program. For the samples not analyzed as part of the CLP program, the following procedures will be used by the laboratory sample custodian, once the samples have arrived at the laboratory:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian will sign the COC and record the date and time received. The sample custodian also will assign a unique laboratory sample number to each sample.

- Cooler temperature (temperature vial) will be checked and recorded.
- Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the FTL as part of the corrective action process. A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.
- If all data and samples are correct and there has been no tampering with the custody seals, the "Received by Laboratory" box will be signed and dated.
- Samples will be stored in a secured area and at a temperature of approximately 4 degrees Celsius, if necessary, until analyses are to begin.
- The laboratory will send a sample acknowledgment letter to the PC as a record that the shipment arrived and the conditions of the containers upon arrival. Any discrepancy will be identified and corrective actions performed. The PC may need to provide guidance concerning additional actions. A copy of the sample acknowledgment will be retained with the COC by the PM.
- All samples, including those analyzed by the close-support laboratory (CSL), will be accompanied by a COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person, or to the laboratory. Overnight carriers will be treated as a single entity, and a single signature will be required when samples are delivered to the laboratory.
- A laboratory COC form will accompany the sample or sample fraction through final analysis for control.
- Copies of the COC and request-for-analysis forms will accompany the laboratory report and will become a permanent part of the project records.
- Samples must be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed COC form enclosed in each sample box or cooler.
- All packages must be accompanied by a COC form identifying the contents. The original record must accompany the shipment, and the FTL must retain a copy. Additional details about laboratory sample custody will be included in the laboratory comprehensive quality assurance plan (CompQAP).

2.4 Analytical Methods Requirements

This section includes brief descriptions of the methods and QC required for screening procedures commonly used to conduct work efforts. The methods and QC procedures are from the following:

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (**U.S. EPA SW-846, Third Edition, and its first and second and third updates, 1997**)
- *Methods for Chemical Analysis of Water and Waste* (**U.S. EPA, 1983**)
- *ASTM Annual Book of Standards* (**ASTM, 1993**)
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition.* (**EPA, January 1999**). Compendium Methods TO-14A, 15, 16, 17 EPA 635/R-96-010b.
- *Contract Laboratory Program Statement of Work for Organic Analysis, Low Concentration Water* (**U.S. EPA OLC03.2, December, 2000**)
- Equipment Manufacturer's Instructions

There will be four different laboratories involved in the analyses of these samples. The analytical screening methods contained in this section, including sample matrix and designated laboratory (if applicable) for each analysis, are shown on **Table 2-2**. A brief summary of the specific analyses performed by each laboratory is as follows:

- CLP Laboratory - CLP Low Concentration Volatile analysis
- Onsite Laboratory - Soil Gas Vapor analysis for selected volatile compounds
- Offsite Laboratory - Rapid turn-around-time Volatile analysis, Soil Gas Vapor analysis for selected volatile compounds.

2.4.1 Field Screening and Analysis Method Descriptions

This section describes the various field-screening and field-analysis methods expected to be utilized during the RI field investigation. These methods provide Level I or Level II data collection technology/documentation, as indicated on **Table 2-2**.

2.4.1.1 SW846/9040B (Water) — pH

Water samples will be measured for pH using Method SW9040B. Measurements are determined electrometrically using either a glass electrode in combination with a reference potential, or a combination electrode. The person taking the measurement shall follow the manufacturer's recommended instructions for instrument calibration, operation, and maintenance.

2.4.1.2 SW846/9050 (Water) — Conductance and Temperature

Standard conductivity meters, which also measure water temperature, shall be used for this measurement. The person taking the measurement shall follow the manufacturer's recommended instructions for instrument calibration, operation, and maintenance.

2.4.1.3 EPA Method 170.1 (Water) — Temperature

Temperature measurements are made with a mercury-filled or dial-type centigrade thermometer, or a thermistor.

2.4.1.4 EPA Method 360.1 (Water) — Dissolved Oxygen

An instrumental probe, usually dependent upon an electrochemical reaction, is used for determination of DO in water. Under steady-state conditions, the current or potential can be correlated with DO concentrations. The person taking the measurement shall follow the manufacturer's recommended instructions for instrument calibration, operation, and maintenance.

2.4.1.5 ASTM D1498-93 — Oxidation-Reduction Potential

This method is designed to measure the ORP in water, which is defined as the electromotive force between a noble metal electrode and a reference electrode when immersed in a solution.

2.4.1.6 PID or FID — Organic Vapor Gas Screening

Two types of portable analyzers are used to perform real-time non-specific analyses of hydrocarbon vapors. The instruments include a flame ionization detector (FID), (such as the Foxboro Century organic vapor analyzer, or OVA) and a photo ionization detector (PID), (such as the HNu® Systems trace gas analyzer, or HNu organic vapor monitor). One or more of these instruments may be used at a specific site, depending on the contaminant species of interest. When used together, the instruments provide complimentary information because they are sensitive to different types of hydrocarbon vapors.

The portable analyzers shall be used as screening tools to help determine the optimum locations for the collection of samples. Field data recorded on the COC forms give the laboratory analysts an indication of the approximate concentration of contaminants and aid in calculating dilution factors before analysis. Additionally, the real-time instruments are used to aid in selecting the proper level of personal protective equipment and monitoring air emissions during sampling activities. The comparability of results obtained from the FID and PID instruments can be considered only to be within the variability of this type of screening instrument. Comparability is greatest when the instruments are calibrated with the same standards and operated within similar concentration ranges.

2.4.2 Analytical Methods for Selected Volatile Organics

The Griggs and Walnut Work Plan and FSP indicated that a CSL will be used for the analysis of the soil gas vapor from soil vapor monitor well nests and/or direct push technology. The onsite laboratory will analyze the samples following SW846/8021A for PCE. Samples from specific locations will be sent to an offsite laboratory for PCE analysis by EPA Method TO-14A for confirmatory analysis.

2.4.2.1 SW846/8021 — Volatile Compounds

The onsite laboratory will analyze the soil gas vapor for PCE by Method SW846/8021A. A representative aliquot of the sample is introduced into a gas chromatograph, where the compounds are separated, and detected by an Electrolytic Conductivity Detector (ELCD).

2.4.2.2 EPA TO-14A — Volatile Compounds

The offsite laboratory will analyze the soil gas vapor for selected volatile compounds, CTC and chloroform, by EPA Method TO-14A. A representative aliquot of the sample is introduced into a gas chromatograph, where the compounds are separated, and detected by a mass spectrometer (GC/MS). This method is being used in order to reach lower reporting limits for PCE for specific sample locations.

2.4.3 Analytical Methods for Organics

Analytical data collected will include organics. SW846 provides the technical framework for commercial environmental testing laboratories to apply SW846 analytical methods for the preparation/isolation, detection, and quantitative measurement of organic and inorganic target compounds in water and soil environmental samples.

The CLP laboratory will analyze the soil and water samples for VOCs following the CLP SOW for organic analysis for low concentration water and SW846/5035/8260B for analysis of soil samples. A representative aliquot of the sample is introduced into a GC, where the compounds are separated, and detected by a MS.

2.4.4 Analytical Methods for IDW Samples

This section describes analyses that will be conducted on the IDW samples. Depending on the findings of the RI and the actual disposition of the IDW, not all of the following methods may be run.

2.4.4.1 SW846/1311

The IDW samples will undergo the Toxicity Characteristic Leaching Procedure (TCLP). The "leachate" obtained from this procedure will then be extracted/digested and analyzed by the methods listed in the following subsection.

2.4.4.2 Organics

The IDW sample "leachates" will be measured for VOC content. The method to be utilized will be SW846/8260B (for volatile organics).

2.4.5 Reporting Limits and Data Package Requirements

Project-specific method target compound lists and reporting limits are summarized in **Table 2-3**. The laboratories will provide EPA CLP packages for the VOCs, and EPA CLP packages or equivalent, VOCs and soil organic vapor (SOV) analyses, as listed in **Table 2-4**.

2.5 Quality Control Requirements

Quality control samples will be collected and or prepared to facilitate the evaluation of the field sample data quality. The types of QC samples associated with each data quality level are summarized in **Table 2-5**.

2.5.1 Field QC Samples

Field QC Samples will include the following:

Trip Blanks are used to monitor potential VOC contamination introduced during sample shipping and handling. Trip blanks are 40-milliliter (mL) VOC vials of American Society for Testing and Materials (ASTM) Type II water that are filled in the laboratory, transported to the sampling site, and returned to the laboratory with the VOC samples. Trip blanks are prepared and analyzed for VOCs only. Trip blanks are not opened in the field. One trip blank will be included with each cooler containing samples for VOC analysis. A trip blank will not be collected for the SOV analyses.

Equipment rinsate blanks (ERBs) are samples of ASTM Type II water passed through and over the surface of decontaminated sampling equipment. ERBs are used to monitor the effectiveness of the decontamination process. The rinse water is collected in sample bottles, preserved, and handled in the same manner as the samples. They are then analyzed in the laboratory in the same manner as the samples. One ERB per 20 samples or one per equipment type per day will be collected. Soil gas samples will be taken at the well head using a metal coupling, therefore an ERB will not be collected for the SOV analyses.

Field Blanks (FBs) are samples of the water used to verify the effectiveness of the decontamination and steam cleaning of sampling equipment. This blank is a measure of sample contamination resulting from ambient field conditions, and also monitors potential contamination introduced from the decontamination water. Each FB will be collected by pouring ASTM reagent grade water over the decontaminated equipment and collecting the water in the appropriate sample container. One FB will be collected per 20 samples for each media sampled during the sampling event.

Duplicate field samples (FD), which are "blind" to the laboratory (i.e. the identity of the FDs is not noted on the laboratory COC form), are collected to monitor the precision of the field sampling process. The FTL will choose one sample and collect duplicate aliquots. The identity of the FD will be recorded in the field sampling logbook, and this information will be forwarded to the data quality evaluation team to aid in the review and evaluation of the data. FDs will be collected at a rate of 1 per 10 field samples.

Temperature blanks (TB) are sent with each cooler shipped to the offsite laboratory containing samples requiring preservation at 4 degrees Celsius. TBs consist of a non-preserved VOC vial or similar laboratory container filled with ASTM reagent grade water. TBs are measured at the laboratory upon receipt to verify the temperature of the samples contained in that cooler. One TB will be shipped with each cooler to each offsite lab.

2.5.2 Matrix Spike/Matrix Spike Duplicate

For matrix spike/matrix spike duplicate (MS/MSD) samples, three aliquots of a single sample are analyzed: one native and two spiked with target compounds (organic analyses) or metals. Spike recovery is used to evaluate potential matrix interferences as well as accuracy. The duplicate spike results are compared to evaluate precision. One MS/MSD set per 20 field samples will be collected for VOCs, herbicides, and nitrate. A MS/MSD set will not be collected for the SOV analyses.

2.5.3 Field and Laboratory Corrective Action

The following section describes the corrective action process. Corrective action may be necessary if the procedures outlined in the previous sections are noted.

2.5.3.1 Field Corrective Action

The PM is responsible for overseeing the corrective action process, but any team member may initiate the process. The corrective action process consists of identifying a problem, acting to eliminate the problem, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated, and documenting the corrective action.

Documentation of the problem is important to overall management of the study. A corrective action request form for problems associated with sample collection is completed by the person discovering the QA problem. The Corrective Action Request Form (**Figure 2-1**) identifies the problem, establishes possible causes, and designates the person responsible for action. The responsible person will be either the PM, PC, or FTL.

The form includes a description of the corrective action and has space for follow-up comments. The PM will verify that the initial action has been taken and that it appears to be effective and, at an appropriate later date, check to see if the problem has been fully resolved. The PM will receive a copy of all corrective action request forms and enter them into the corrective action log. This permanent record will aid the PM in follow-up and assist in resolving QA problems.

Examples of corrective action are correcting COC forms, problems in sample collection, packing, shipping, field record keeping, or additional training in sampling. Additional approaches may include:

- Resampling
- Evaluating and amending sampling procedures.

2.5.3.2 Laboratory Corrective Action

The laboratory department supervisors review the data generated to verify that all QC samples have been run as specified in the procedure. Laboratory personnel are alerted that corrective actions may be necessary under the following conditions:

- QC data are outside the warning or acceptable windows for precision and accuracy established for laboratory samples.
- Blanks contain contaminants at concentrations above the levels specified in the Laboratory CompQAP for any target compound.
- Deficiencies are detected by the laboratory QA director during internal or external audits, or from the results of performance evaluation samples.
- Corrective actions are implemented immediately when nonconformances in QC sample results are identified by the bench analyst. Corrective action procedures are handled initially at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors and checks such parameters as instrument calibration, spike and calibration mixes, and instrument sensitivity.

The analyst immediately notifies his or her supervisor of the problem and the investigation being done. If the problem persists or cannot be identified, the matter must be referred to the laboratory supervisor and QA/QC officer for further investigation. All laboratory QC problems that will impact the final data must be discussed with the PC as part of the corrective action process. Once resolved, full documentation of the corrective action procedure must be filed with the laboratory supervisor,

and the QA/QC officer must be provided with a corrective action memorandum for inclusion into the project file if data are affected (confirmation of communication memo).

Corrective actions may include:

- Re-analyzing suspect samples
- Resampling and analyzing new samples
- Recalibrating analytical instruments with fresh standard
- Eliminating contamination in blank samples
- Evaluating and amending sampling and analytical procedures
- Accepting data with an acknowledged level of uncertainty
- Qualifying or rejecting the data.

After implementation of the required corrective action measures, data that are deemed unacceptable may not be accepted by the PM and follow-up corrective actions may be explored. Details of laboratory corrective actions are provided in the laboratory CompQAP.

2.6 Instrument Testing, Inspection, and Maintenance Requirements

This section describes the inspection/acceptance of environmental sampling and measurement systems/components to ensure their intended use as specified by the design.

2.6.1 Field Instruments

All equipment used for field measurements will be maintained in accordance with the manufacturer's instructions. Routine maintenance and all equipment repairs will be documented in the site log book. Whenever a piece of equipment fails to operate properly, the instrument either will be repaired in-house if possible, or sent out for repairs, and another instrument equivalent to the original will be substituted, if possible.

2.6.2 Analytical Laboratory Instruments

Preventive maintenance for laboratory instruments is discussed in greater detail in the laboratory's CompQAP.

It is required that designated laboratory personnel will be trained in routine maintenance procedures for all major instrumentation. Either trained staff or trained service engineers/technicians employed by the instrument manufacturer will make repairs. The laboratory shall have multiple instruments that will serve as backup to minimize potential down time. All maintenance will be documented and kept in permanent logs. These logs will be available for review by auditing personnel.

2.6.3 Audits

Audits of the field team and laboratories will be determined by the PM and may be carried out by external project/program team members.

2.7 Instrument Calibration and Frequency

This section references how instrument calibration will be conducted using certified equipment and/or standards with known valid relationships to nationally recognized performance standards.

2.7.1 Field Instruments

Field instruments will be calibrated daily before beginning sampling activities. All field instruments will be calibrated in accordance with the manufacturer's specifications. Standards used to calibrate the field survey instruments will be traceable to National Institute of Standards and Technology (NIST) standards. The method and frequency of calibration for the instruments used for each field activity are described in the manufacturer's instructions and summarized briefly in **Table 2-6**.

The pH, DO, ORP, and conductivity meters will be decontaminated before each sample is measured. The probes will be rinsed three times with ASTM Type II water before storage each day. The meters will be checked for battery charge and physical damage each day. The meters, pH standard solutions,

and conductivity buffer solutions will be stored in a cool, dry environment. Standard solutions will be discarded on their expiration dates.

2.7.2 Laboratory Equipment

Laboratory instruments will be calibrated in accordance with the manufacturer's directions and applicable method specifications. Laboratory instrument calibration procedures will be summarized in the Laboratory CompQAP and will be reviewed and approved by the PM or his designee before samples are submitted to the laboratory.

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Table 2-1
Sample Containers, Preservatives, and Holding Time
Griggs and Walnut Groudnwater Plume Site - RI/FS

Analytical Fraction	Method	Matrix	Number of Containers	Container Size/Type	Preservative	Holding Time
Groundwater						
VOCs	CLP OLC3.2	water	3	40 mL, G	HCl pH<2, chill 4EC	14 days
Alkalinity	E310.1	water	1	50 mL, G, P	4 EC	14 days
Total Hardness	E130.2	water	1	500 mL, G, P	HNO_3, pH<2, chill, 4 EC	180 days
Common Anions	E300.0	water	1	50 mL, G, P	None	28 days for chloride, sulfate, nitrate, and phosphate
TOC	SW846/ 9060	water	1	500 mL, G, P	HCl or HNO_3, pH<2, 4 EC	28 days
Soils						
VOCs	CLP	soil	2	EnCore™	chill to 4EC	48 hours
Unsaturated Hydraulic Conductivity	ASTM D5084	soil	1	6" x 2" undisturbed soil core	seal to retain moisture	N/A
Bulk Density	ASTM D2166	soil	N/A	N/A[1]	N/A	N/A
Grain Size	ASTM D422	soil	1	500 grams[1]	N/A	N/A
Specific Gravity	ASTM D854	soil	1	100 grams[1]	N/A	N/A
Moisture	ASTM D2216	soil	1	100 grams[1]	N/A	N/A
TOC	SW9060	soil	1	8 oz	chill 4EC	28 days
Soil Vapor						
VOCs[2]	TO-14A	gas	1	6L SUMMA Canister	N/A	14 days
VOCs[3]	SW846/ 8021mod	gas	1	Gas-tight syringe	N/A	1 hour
Chemical/Physical Parameters of DNAPL						
BTU	D240-92 (1997e1)	Liquid	1	Metal Paint Can (MPC) 1L	None	
pH	9094C	Liquid	1	Amber glass 1L	Cool 4EC	
Liquid Content	9095	Liquid	1	Amber glass 1L	None	
Ash Content	D2415-97	Liquid	1	MPC 100 mL	None	
Viscosity	5018-89 (1994e1)	Liquid	1	MPC 1L	None	
Density	D4892-89 (1994)e2	Liquid	1	MPC 1L	None	

Table 2-1
Sample Containers, Preservatives, and Holding Time
Griggs and Walnut Groudnwater Plume Site - RI/FS

Analytical Fraction	Method	Matrix	Number of Containers	Container Size/Type	Preservative	Holding Time
VOCs	8260B	Liquid	3	3-40 mL VOA	HCl pH<2, cool 4EC	14 days
SVOCs	8270C	Liquid	2	2-1L glass	4EC	7/40 days
Inorganics	6010B	Liquid	1	1L glass	HNO_3 pH<2, cool 4EC	6 months
Soil IDW Characterization						
VOCs	SW846/ 8260B	soil	1	4 oz G, or EnCore	chill 4EC	14 days for leaching, 14 days for analysis

Notes: [1]Grain size, specific gravity, and moisture analyses can be combined in 2-8 oz containers, no separate container required for bulk density .
[2]To be analyzed by offsite laboratory.
[3]To be analyzed by CSL.

Table 2-2
Analytical Methods
Griggs and Walnut Groundwater Plume Site - RI/FS

Method	Parameter	Level of Analysis	Sample Matrix	Laboratory
[1]Groundwater Sampling				
CLP Organics (OLC03.2)	Low Concentration VOC	Level IV	Water	CLP lab
EPA 310.1	Alkalinity	Level III	Water	Subcontract lab
EPA 130.2	Total Hardness	Level III	Water	Subcontract lab
EPA 300.0	Cations/Anions	Level III	Water	Subcontract lab
SW 9060	TOC	Level III	Water	Subcontract lab
SW846/9040B	PH	Level I	Water	field meas.
SW846/9050	Conductance	Level I	Water	field meas.
E170.1	Temperature (water)	Level I	Water	field meas.
E360.1	Dissolved oxygen (water)	Level I	Water	field meas.
ASTM D1498	Oxidation-reduction potential	Level I	Water	field meas.
Soil Sampling				
SW846/5035/8260B	VOCs	Level III	Soil	Subcontract lab
ASTM D5084	Unsaturated Hydraulic Conductivity	Level III	Soil	Geotech lab
ASTM D422	Grain Size	Level III	Soil	Geotech lab
ASTM D854	Specific Gravity	Level III	Soil	Geotech lab
ASTM D2166	Bulk Density	Level III	Soil	Geotech lab
SW846/9060	Total organic carbon	Level III	Soil	Geotech lab
ASTM D2216	Moisture	Level III	Soil	Geotech lab
Soil Vapor Sampling				
(DPT sampling)	Soil Gas Vapor - Volatiles		Gas	
SW846/8021A modified	Soil Gas Vapor - Volatiles (CSL)	Level III	Gas	CSL soil vapor lab
EPA TO-14	Soil Gas Vapor - Volatiles (Fixed lab)	Level III	Gas	offsite soil vapor lab
Chemical/Physical Parameters of DNAPL				
D240-92 (1997e1)	BTU	Level III	Liquid	Subcontract lab
9094	pH	Level III	Liquid	Subcontract lab
9095	Liquid Content	Level III	Liquid	Subcontract lab

Table 2-2
Analytical Methods
Griggs and Walnut Groundwater Plume Site - RI/FS

Method	Parameter	Level of Analysis	Sample Matrix	Laboratory
D2415-97	Ash Content	Level III	Liquid	Subcontract lab
D5018-89 (1994e1)	Viscosity	Level III	Liquid	Subcontract lab
D4892-89 (1994)e2	Density	Level III	Liquid	Subcontract lab
8260B	VOCs	Level III	Liquid	Subcontract lab
8270C	SVOCs	Level III	Liquid	Subcontract lab
6010B	Inorganics	Level III	Liquid	Subcontract lab
Soil IDW Characterization				
SW846/1311	Toxicity Characteristic Leaching Procedure	Level III	Soil	non-CLP lab
SW846/8260B	Selected VOCs	Level III	Soil	non-CLP lab

Notes: [1] Excludes preliminary samples obtained for rapid turn-around-time from initial well sampling and vertical extent characterization for offsite analysis.

Table 2-3
Target Compound Lists and Reporting Limits
Griggs and Walnut Groundwater Plume Site - RI/FS

Target Compound	Reporting Limit			
	Groundwater (µg/L)	Soil Vapor (µg/L)	Leachate (mg/L)	Soil (µg/kg)
Water Volatile Organic Compounds (CLP Low-level method)				
1,1-Dichloroethane	0.5			
1,1-Dichloroethene	0.5			
1,2-Dichloroethane	0.5			
cis-1,2-Dichloroethene	0.5			
trans-1,2-Dichloroethene	0.5			
1,2-Dichloropropane	0.5			
cis-1,3-Dichloropropene	0.5			
trans-1,3-Dichloropropene	0.5			
Tetrachloroethene	0.5			
Trichloroethene	0.5			
Vinyl chloride	0.5			
Soil Volatile Organic Compounds (for Modified SW-846 Method 5035				
1,1-Dichloroethane				10
1,2-Dichloroethane				10
1,1-Dichloroethene				10
cis-1,2-Dichloroethene				10
trans-1,2-Dichloroethene				10
Tetrachloroethene				10
Trichloroethene				10
Vinyl Chloride				10
Soil Organic Vapor (by SW-846 Method 8021A modified)				
1,1-Dichloroethane		1.0		
1,1-Dichloroethene		1.0		
1,2-Dichloroethane		1.0		
cis-1,2-Dichloroethene		1.0		
trans-1,2-Dichloroethene		1.0		
Tetrachloroethene		1.0		
Trichloroethene		1.0		
Vinyl Chloride		1.0		
Soil Organic Vapor (by EPA Method TO-14A)				
1,1-Dichloroethane		0.1		
1,1-Dichloroethene		0.1		
1,2-Dichloroethane		0.1		
cis-1,2-Dichloroethene		0.1		
trans-1,2-Dichloroethene		0.1		
Tetrachloroethene		0.1		
Trichloroethene		0.1		
Vinly Chloride		0.1		

Table 2-3
Target Compound Lists and Reporting Limits
Griggs and Walnut Groundwater Plume Site - RI/FS

TCLP Volatiles				
Benzene			0.1	
Butanone, 2- (Methyl ethyl ketone) (MEK)			0.4	
Carbon Tetrachloride			0.1	
Chlorobenzene			0.1	
Chloroform (*Trichloromethane) (THM)			0.1	
Dichloroethene, 1,1-			0.1	
Tetrachloroethene (PCE)			0.1	
Trichloroethene (TCE)			0.1	
Vinyl Chloride			0.1	

Notes: ug/L micrograms per liter
mg/L milligrams per liter
mg/kg milligrams per kilogram

Table 2-4
Data Package Requirements
Griggs and Walnut Groundwater Plume Site - RI/FS

All Analytical Fractions	
Case Narrative -- A detailed case narrative for each analytical fraction is required and will include explantion of any non-compliance and/or exceptions, corrective action taken, and outcome of corrective action. Exceptions will be noted for receipt, holding times, and analytical methods, preparation, calibration, blanks, spikes, surrogates (where applicable), and sample exceptions.	C
Sample ID Cross Reference Sheet (Lab ID's and Client ID's	C
Completed Chain of Custody and any sample receipt information	C
Copies of non-conformance memos and corrective actions	C
Copies of all unreduced instrument data (Level 4 only - CLP Low Concentration VOCs)	C

Form *	Organic Fractions	GC/MS Analyses	GC Analyses
1	Sample results w/lab sample ID, client sample ID, and station ID	C	C
2	Surrogate Recovery Summary (w/applicable control limits)	C	C
3	MS/MSD Accuracy & Precision Summary with RPD calculated according to method specifications (CLP using % recovery, SW-846 using concentration) -- including spike added, percent recovery, and applicable control limits	C	C
3	LCS Accuracy Summary (including spike added, percent recovery, and applicable control limits)	C	C
4	Method Blank Summary	C	C
5	Instrument Tuning Summary (including tuning summary for applicable initial calibrations)	C	
6	initial Calibration Summary (including concentration levels of standards)	C	C
6	Initial Calibration Summary (Retention Times (RT), Response or Calibration Factors, and linearity demonstration)	C	
7	Continuing Calibration Summary	C	C
7	Continuing Calibration Summary (Unique Instrument/Column ID, Rts, RT windows, calibration or response factors, percent difference or drift -- as appropriate to method)		C
8	Internal Standard Summary (including internal standard summary for applicable initial calibrations)	C	C
8	Analytical Sequence -- For every analysis associated with a particular analytical sequence starting with the initial calibration, enter the client sample identification, lab sample identifier, and date and time of analysis. Each sample analyzed as part of the sequence shall be reported on Form 8 even if it is not associated with the batch/SDG. The laboratory shall use ZZZZZ as the client sample identification to distinguish all samples that are not part of the batch/SDG being reported.		C
10	Compound Identification Summary (where confirmation required) -- including RT, RT windows, concentration for detected compounds on both columns, and percent difference between results		C

Form *	Inorganic Fractions	
1	Sample results w/lab sample ID, client sample ID, and station ID	C
2A	Initial and Continuing Calibration Summary	C
3	Initial and Continuing Calibration Blanks and Method Blanks Summary	C
5A	Pre-digestion Matrix Spike Recoveries Summary	C
6	Native Duplicate or MS/MSD Precision Summary	C
7	Laboratory Control Sample Recovery Summary	C
10	Instrument or Method Detection Limit Summary	C

* CLP Form or Summary form with equivalent information

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Table 2-5
Quality Control Samples
Griggs and Walnut Groundwater Plume Site - RI/FS

Type	Level 1	Level 3	Level 4
Field Duplicate	X	X	X
Field Blank		X	X
Equipment Blank		X	X
Trip Blank		X*	X
Matrix Spike/MSD		X	X
Method Blank		X	X
Laboratory Control Sample		X	X

* VOCs only

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Table 2-6
Instrument Calibration and Frequency
Griggs and Walnut Groundwater Plume Site - RI/FS

Instrument	Calibration Activity	Frequency
Dissolved Oxygen meter	Calibrate to atmosphere	Beginning of each sampling day
Oxidation-reduction meter	Check ORP reading with a solution of known ORP (i.e. Zobell solution)	Beginning of each sampling day
pH Meter	Calibrate against standard pH solution (4.0SU and 7.0SU and 10.0 SU)	Beginning of each sampling day
Specific Conductivity Meter	Check conductivity reading with a solution of known conductivity	Beginning of each sampling day

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Figure 2-1
Corrective Action Request Form
Griggs and Walnut Groundwater Plume Site

Originator: _____ Date: _____

Person responsible for replying: _____

Description of problem when identified: _____

_____

_____

Sequence of Corrective Action (CA): (Note, if no responsible person is identified, submit this form directly to the project manager)

State date, person, and action planned:

_____

_____

_____

_____

_____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approval by: _____ Date: _____

Information copies to: _____

Responsible Person: _____

Field Team Leader: _____

Project Manager: _____

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Section 3
Assessments and Oversite

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Section 3

Assessments and Oversight

Assessment and oversight activities are performed to determine whether the QC measures identified in the Work Plan and QAPP are being implemented and documented as required. Audits and reviews are the tools to implement this process. For example, during a review the auditor may check that a monitor well has been correctly sampled or that the field QC samples were collected at the appropriate frequency. During an audit or review, the auditor may check for:

- Adherence to the site-specific plans
- Documentation of the process or system
- Proper identification, resolution, and documentation of nonconformance with the process or system
- Correction of identified deficiencies

3.1 Assessments and Response Actions

The need for an audit can be determined independently by the PM. Assessment activities may include surveillance, inspection, peer review, management system review, readiness review, technical systems audit, performance evaluation, and data quality assessment. The PM will be responsible for initiating audits, selecting the audit team, and overseeing audit implementation.

Audits of the analytical laboratories will be performed by the PC or designee in compliance with the subcontract.

Field audits will be conducted by the PC or other review team member as designated by the PM.

3.1.1 Laboratory Performance and Systems Audits

Laboratory systems will be audited in accordance with project requirements. Contracted laboratories must submit a Laboratory CompQAP. The CompQAP must include relevant standard operating

procedures, a description of the laboratory's internal procurement policies, and its corrective action program.

The laboratory audits will address at least the following issues:

- Is the laboratory operation being performed as required by the subcontract?
- Are internal laboratory operations being conducted in accordance with the laboratory CompQAP?
- Are the laboratory analyses being performed in accordance with method requirements?

Any nonconformance noted during an audit will result in a corrective action.

3.1.2 Field Team Performance and System Audits

The PC or other member of the review team as designated by the PM may conduct an audit of the field activities in accordance with the program requirements. The audit will address at least the following issues:

- Are sampling operations being performed as stated in the site-specific work plan?
- Are the sample labels being filled out completely and accurately?
- Are the COC records complete and accurate?
- Are the field notebooks being filled out completely and accurately?
- Are the sampling activities being conducted in accordance with the site-specific work plan and approved standard operating procedures?
- Are the documents generated in association with the field effort being stored as described in the site-specific work plan?

The generation and documentation of field data will also be audited. The audits will focus on verifying that proper procedures are followed so that subsequent sample data will be valid. Any nonconformance noted during an audit will result in corrective action.

The results of the assessment and oversight activities will be reported back to the PM, who has ultimate responsibility for ensuring that the corrective action response is completed, verified, and documented.

3.2 Reports to Management

Reports to the PM include project status reports, the results of evaluation and system audits, data quality assessments, and significant QA problems and recommended solutions. The status reports, submitted in accordance with the requirements of site-specific work plan, will discuss at least current activities, problems encountered and their resolution, and planned work.

QA reports will be submitted in accordance with the site-specific work plan. QA reports document implementation of the QAPP and the results of the site -specific QA/QC audits. A final QA report must be submitted as part of each project's final report. The topics to be covered are outlined in the site-specific work plan, but each will include at least the following information:

- Identification of nonconformances that required corrective action and resolution of the nonconformance
- Data quality assessment in terms of precision and accuracy and how they affect the usability of the analytical results
- Limitations of the qualified results and a discussion of rejected results
- Discussion of the field and laboratory QA/QC sample results
- Results of external laboratory audits.

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Section 4
Data Review, Validation, and Verification Requirements

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Section 4

Data Review, Validation, and Verification Requirements

4.1 Data Review and Validation

Data review and validation are processes whereby data generated in support of this project are reviewed against the QA/QC requirements. The data are evaluated for precision, accuracy, and completeness against the analytical protocol requirements. Nonconformances or deficiencies that could affect the usability of data are identified as noted.

4.1.1 Level 1-Field Survey Data

Field instruments used to collect field surveys (or bulk measurements such as pH or conductivity) are direct reading, thus making field calculations and subsequent data reduction unnecessary. Field data will be recorded in the site log books by appropriately trained field personnel. Field data will include the following:

- Instrument identification
- Calibration information (standards used and results)
- Date and time of calibration and sample measurement
- Sample results
- Supporting information if appropriate

Data will be reviewed by the FTL, who is responsible for the collection and verification of all field data while in the field. Recorded data will be accepted or rejected by the FTL before leaving the sampling site. Extreme readings (readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and/or if the readings are verified by re-testing.

Field documentation, sample data, instrument calibrations, and QC data will be reviewed by the PM (or a designee) before being included in the project files.

4.1.2 Level 3 and 4-Laboratory Analyses

The data package deliverables associated with Levels 3 and 4 are listed in **Table 2-4**. Level 3 essentially contains the QC summary forms, where level 4 is the same as level 3, but also includes the raw instrument printouts such as quantitation reports and chromatograms.

The PC or designee will perform data quality evaluation. The data quality evaluation process is used to assess the effect of the overall analytical process on the usability of the data. Two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements and is a straight-forward examination; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of the matrix interferences is more subtle and involves analysis of several results including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

Before the analytical results are released by the laboratory, both the sample and QC data will be reviewed carefully to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data will be reduced and spike recoveries will be included in control charts, and the resulting data will be reviewed to ascertain whether they are within the laboratory-defined limits for accuracy and precision. Any non-conforming data will be discussed in the data package cover letter and case narrative. The laboratory will retain all of the analytical and QC documentation associated with each data package.

The data package will be reviewed by the PCs using the process outlined in the guidance document U.S. EPA *Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review* (**EPA, 2001**). For non-CLP methods, the validation will be performed in a process analogous to NFG, but will use QC criteria established in the method. The data review and validation process is independent of the laboratory's checks. It focuses on the usability of the data to support the project data interpretation and decision-making process. Areas of review include data package completeness, holding time compliance, initial and continuing calibration, spiked sample results, method blank results, and duplicate sample results. A data review worksheet will be

completed for each data package. Acceptance criteria for each area of review are specified in the analytical method. For example, acceptance criteria for initial and continuing calibration are specified in each analytical method; any non-conformances will be noted on the data review worksheets and the effect of the non-conformance on the overall usability of the data will be evaluated as part of the overall data quality evaluation.

Samples that do not meet the acceptance limit criteria will be indicated with a qualifying flag, which is a one or two-letter abbreviation that indicates a problem with the data. Flags used in the text may include the following:

- U Undetected. Analyte was analyzed for but not detected above the method detection limit.
- J Estimated. The analyte was present, but the reported value may not be accurate or precise.
- UJ Detection limit estimated. The analyte was not detected above the detection limit, but the actual detection limit may be estimated.
- R Rejected. The data were rejected because the corresponding QC data were not within the method-specified limits.

It is important to note that laboratory qualifying flags are included on the data summary forms (Form I) that are submitted to the project by the laboratory. However, during the data review and validation process, the laboratory qualifying flags are evaluated and replaced with the project-specific validation flags.

Once each of the data packages has been reviewed, and the data review worksheets completed, then the entire data set will be evaluated for overall trends in data quality and usability. Information summarized as part of the data quality evaluation may include chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set also will be evaluated to identify potential data limitations or uncertainties in the laboratory. Additional areas of review are listed below.

4.1.2.1 Field and Laboratory Blank Contamination

The appearance and concentration of target compounds in field and laboratory blanks as well as environmental samples will be reviewed. Common field sampling and laboratory contaminants detected in blanks include acetone, methylene chloride, and phthalates. Acetone and methylene chloride are used to extract samples in the laboratory, and hence, are common laboratory contaminants. Phthalates are used as plasticizers, the most common of which is bis(2-ethylhexyl)phthalate, and are often introduced during sample handling.

If these compounds are encountered in a method blank at a concentration greater than the practical quantitation limit (PQL), corrective actions will be taken in an attempt to eliminate these compounds. These compounds also may be detected in field blanks above the PQL. In either case, all analytical data above the PQL associated with these compounds will be flagged to indicate possible cross contamination.

4.1.2.2 Surrogate Spike Recoveries

Surrogate spike compounds are added to each sample for the organic analytical methods. Surrogate spike compounds are structurally similar (but not identical) to target compounds and should behave in a similar manner during analysis. Surrogate spike recoveries are used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks are used to evaluate laboratory performance because these blanks represent an ideal sample matrix. Surrogate spike recoveries for field samples are used to evaluate the potential for matrix interferences. When surrogate spike recoveries for field samples fall outside the method target acceptance windows, the samples are re-extracted if appropriate, then re-analyzed. If the surrogate spike recovery is still outside the acceptance window for the re-analyzed sample, then the sample results are qualified as affected by matrix interferences.

4.1.2.3 Matrix Spike Recoveries

For this QC measure, three aliquots of a single sample are analyzed; one native and two spiked with the same concentration of matrix spike compounds. Unlike the surrogate spike compounds, matrix spike compounds are found on the method target compound list. Spike recovery is used to evaluate

potential matrix interferences, as well as accuracy. The duplicate spike results are compared to evaluate precision.

4.1.2.4 Laboratory Control Samples

An aliquot of ASTM Type II water is spiked with target analytes or compounds at concentrations in the middle of the linear calibration range, and then prepared and analyzed with a batch of samples. The laboratory control sample is used to QC a preparation batch.

4.1.2.5 Duplicate Sample Results

Duplicate samples will be collected and analyzed as part of the field effort. Both the native and duplicate samples will be analyzed for the same parameters. Target compounds that are detected in both the native and duplicate samples will be compared and the precision estimated for the sample results calculated.

4.2 Validation and Verification Methods

The data validation process is conducted to assess the effect of the overall sampling and analysis process on the usability of the data. There are two areas of review; laboratory performance evaluation and the effect of matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements and is a straightforward examination. The laboratory either did or did not analyze the samples within the QC limits of the analytical method and according to protocol requirements. The assessment of potential matrix effects consists of a QC evaluation of the analytical results and also the results of testing blank, duplicate, and matrix spike samples, and then assessing how, if at all, the matrix effect will impact the usability of the data.

All analytical data will be supported by a data package and requirements are listed in **Table 2-3**. The data package contains the supporting QC data for the associated field samples. Before the laboratory releases each data package, the laboratory QA officer or the analytical section supervisor must carefully review the sample and laboratory performance QC data to verify sample identity, the completeness and accuracy of the sample and QC data, and compliance to the method duplication.

The EPA or their subcontractors will validate the samples analyzed through the CLP program. For samples that are not analyzed through the CLP program, data validation will be performed by the PC in a manner consistent with the EPA guidance manual *Contract Laboratory Program National Functional Guidelines for Inorganic and Organic Data Review* (**EPA, 2001**). In order to achieve consistent data validation, data worksheets will be completed for each data validation effort that summarize any non-conformances identified with the data.

In addition to the data package deliverables, the laboratories will also provide selected information in an electronic format. Additional information about the electronic data deliverables can be found in the DMP.

4.3 Trend Analysis

Once the data packages for each project have been reviewed, the entire data set will be evaluated for overall trends in data quality and usability. Information summarized as part of the data quality evaluation will include frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set also will be evaluated to identify potential data limitations or uncertainties in the laboratory's analytical processes. The trend analysis results will be included in the validation summary report, which will be submitted to the PM at the end of the field effort. The validation report and notes will be archived with the analytical data.

4.4 Reconciliation with Data Quality Objectives

The final activity of the data quality evaluation is to assess whether the data meets the planned DQOs for this project. The final results, as adjusted for the findings of any data validation/data evaluation, will be checked against the DQOs and an assessment will be made as to whether the data is of sufficient quality to support the DQOs. The decision as to data sufficiency may be affected by the overall precision, accuracy, and completeness of the data as demonstrated by the data validation process. If the data are sufficient to achieve project objectives, the PM will release the data and work can proceed. If the data are insufficient, corrective action will be required.

Section 5
References

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Section 5

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